

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
26 August 2004 (26.08.2004)

PCT

(10) International Publication Number
WO 2004/071522 A1

(51) International Patent Classification⁷: **A61K 38/19**,
31/46, 9/72, A61P 11/06

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(21) International Application Number:
PCT/EP2004/001143

(74) Common Representative: **BOEHRINGER INGELHEIM INTERNATIONAL GMBH**; Binger Strasse 173, 55216 Ingelheim (DE).

(22) International Filing Date: 7 February 2004 (07.02.2004)

(25) Filing Language: English

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only): **BOEHRINGER INGELHEIM INTERNATIONAL GMBH** [DE/DE]; Binger Strasse 173, 55216 Ingelheim (DE).

(26) Publication Language: English

(30) Priority Data:
03002975.5 11 February 2003 (11.02.2003) EP

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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O 2004/071522 A1

(54) Title: NEW PHARMACEUTICAL COMPOSITIONS BASED ON ANTICHOLINERGICS AND SOLUBLE TNF RECEPTOR FUSION PROTEINS

**NEW PHARMACEUTICAL COMPOSITIONS BASED ON ANTICHOLINERGICS
AND SOLUBLE TNF RECEPTOR FUSION PROTEINS**

The present invention relates to novel pharmaceutical compositions based on
5 anticholinergics and soluble TNF receptor fusion proteins, processes for preparing them
and their use in the treatment of respiratory diseases.

Description of the invention

The present invention relates to novel pharmaceutical compositions based on
10 anticholinergics and soluble TNF receptor fusion proteins, processes for preparing them
and their use in the treatment of respiratory diseases.

Surprisingly, an unexpectedly beneficial therapeutic effect, particularly a synergistic effect
can be observed in the treatment of inflammatory and/or obstructive diseases of the
respiratory tract if one or more, preferably one, anticholinergic is used with one or more,
15 preferably one, soluble TNF receptor fusion protein. In view of this synergistic effect the
pharmaceutical combinations according to the invention can be used in smaller doses than
would be the case with the individual compounds used in monotherapy in the usual way.
The effects mentioned above may be observed both when the two active substances are
20 administered simultaneously in a single active substance formulation and when they are
administered successively in separate formulations. According to the invention, it is
preferable to administer the two active substance ingredients simultaneously in a single
formulation.

Within the scope of the present invention the term anticholinergics 1 denotes salts which
25 are preferably selected from among tiotropium salts, oxitropium salts and ipratropium
salts, most preferably tiotropium salts. In the above-mentioned salts the cations tiotropium,
oxitropium and ipratropium are the pharmacologically active ingredients. Within the scope
of the present patent application, any reference to the above cations is indicated by the use
30 of the number 1'. Any reference to compounds 1 naturally also includes a reference to the
ingredients 1' (tiotropium, oxitropium or ipratropium).

By the salts 1 which may be used within the scope of the present invention are meant the
compounds which contain, in addition to tiotropium, oxitropium or ipratropium as
counter-ion (anion), chloride, bromide, iodide, methanesulphonate or
35 para-toluenesulphonate. Within the scope of the present invention, the methanesulphonate,
chloride, bromide and iodide are preferred of all the salts 1, the methanesulphonate and

bromide being of particular importance. Of outstanding importance according to the invention are salts 1 selected from among tiotropium bromide, oxitropium bromide and ipratropium bromide. Tiotropium bromide is particularly preferred. Within the scope of the present invention the term anticholinergics 1 denotes the aforementioned salts optionally in 5 form of their hydrates or solvates. In case of the preferred anticholinergic 1, tiotropium bromide, the crystalline monohydrate as described in WO 02/30928 is of particular interest.

Within the scope of the present invention, the term soluble TNF receptor fusion proteins 10 (hereinafter 2) denotes compounds, which contain at least one TNF alpha binding site derived from a TNF alpha receptor (fused with other protein fragments such as the Fc portion of an immunoglobulin molecule) and which can be modified by pegylation. Of outstanding importance according to the invention are lenercept and etanercept. A particular preferred soluble TNF receptor fusion protein 2 is etanercept .

15 The pharmaceutical combinations of 1 and 2 according to the invention are preferably administered by inhalation. Suitable inhalable powders packed into suitable capsules (inhalettes) may be administered using suitable powder inhalers. The drug may also be inhaled using suitable solutions of the pharmaceutical combination consisting of 1 and 2.

20 In one aspect, therefore, the invention relates to a pharmaceutical composition which contains a combination of 1 and 2. In another aspect the present invention relates to a pharmaceutical composition which contains one or more salts 1 and one or more compounds 2, optionally in the form of their solvates or hydrates. Again, the active 25 substances may be combined in a single preparation or contained in two separate formulations. Pharmaceutical compositions which contain the active substances 1 and 2 in a single preparation are preferred according to the invention.

30 In another aspect the present invention relates to a pharmaceutical composition which contains, in addition to therapeutically effective quantities of 1 and 2, a pharmaceutically acceptable excipient. In another aspect the present invention relates to a pharmaceutical composition which does not contain any pharmaceutically acceptable excipient in addition to therapeutically effective quantities of 1 and 2.

The present invention also relates to the use of 1 and 2 for preparing a pharmaceutical composition containing therapeutically effective quantities of 1 and 2 for treating inflammatory and/or obstructive diseases of the respiratory tract, particularly asthma or chronic obstructive pulmonary disease (COPD). Other diseases where the combination is 5 useful are inflammatory diseases of the lung associated with fibrosis, such as cystic fibrosis and idiopathic pulmonary fibrosis and inflammatory diseases of the upper airways such as rhinitis.

The present invention also relates to the use of 1 for preparing a pharmaceutical 10 composition for treating inflammatory and/or obstructive diseases of the respiratory tract, particularly asthma or chronic obstructive pulmonary disease (COPD), characterized in that a therapeutically effective quantity of 2 is used as well.

The present invention also relates to the simultaneous or successive use of therapeutically 15 effective doses of the combination of the above pharmaceutical compositions 1 and 2 for treating inflammatory and/or obstructive diseases of the respiratory tract, particularly asthma or chronic obstructive pulmonary disease (COPD) as well as allergic and non-allergic rhinitis, cystic fibrosis, and idiopathic pulmonary fibrosis by simultaneous or successive administration.

20 In the active substance combinations of 1 and 2, ingredient 1 may be present in the form of enantiomers, mixtures of enantiomers or in the form of racemates, whilst ingredient 2 may be present as a glycosylated protein whereby the degree and type of glycosylation may be varied.

25 The proportions in which the two active substances 1 and 2 may be used in the active substance combinations according to the invention are variable. Active substances 1 and 2 may possibly be present in the form of their solvates or hydrates. Depending on the choice of the compounds 1 and 2, the weight ratios which may be used within the scope of the 30 present invention vary on the basis of the different molecular weights of the various compounds and their different potencies.

As a rule, the pharmaceutical combinations according to the invention may contain 35 compounds 1 and 2 in ratios by weight ranging from 1:2000 to 1:1, preferably from 1:1000 to 1:5. In the particularly preferred pharmaceutical combinations which contain tiotropium

salt as compound 1, the weight ratios of 1 to 2 are most preferably in a range in which ipratropium or tiotropium 1' and 2 are present in proportions of 1:500 to 1:10, more preferably from 1:200 to 1:20. For example, without restricting the scope of the invention thereto, preferred combinations of 1 and 2 according to the invention may contain

5 tiotropium 1' and anti TNF receptor fusion protein 2 in the following weight ratios: 1:200
1:100; 1:90; 1:85; 1:80; 1:75; 1:70; 1:65; 1:60; 1:55; 1:50; 1:49; 1:48; 1:47; 1:46; 1:45;
1:44; 1:43; 1:42; 1:41; 1:40; 1:39; 1:38; 1:37; 1:36; 1:35; 1:34; 1:33; 1:32; 1:31; 1:30;
1:29; 1:28; 1:27; 1:26; 1:25; 1:24; 1:23; 1:22; 1:21; 1:20

10 The pharmaceutical compositions according to the invention containing the combinations of 1 and 2 are normally administered so that 1 and 2 are present together in doses of 1 to 10000 μ g, preferably from 10 to 5000 μ g, more preferably from 100 to 5000 μ g, better still from 1000 to 2000 μ g per single dose. For example, combinations of 1 and 2 according to the invention contain a quantity of tiotropium 1' and 2 such that the total dosage per single dose is about 100 μ g, 105 μ g, 110 μ g, 115 μ g, 120 μ g, 125 μ g, 130 μ g, 135 μ g, 140 μ g, 145 μ g, 150 μ g, 155 μ g, 160 μ g, 165 μ g, 170 μ g, 175 μ g, 180 μ g, 185 μ g, 190 μ g, 195 μ g, 200 μ g, 205 μ g, 210 μ g, 215 μ g, 220 μ g, 225 μ g, 230 μ g, 235 μ g, 240 μ g, 245 μ g, 250 μ g, 255 μ g, 260 μ g, 265 μ g, 270 μ g, 275 μ g, 280 μ g, 285 μ g, 290 μ g, 295 μ g, 300 μ g, 305 μ g, 310 μ g, 315 μ g, 320 μ g, 325 μ g, 330 μ g, 335 μ g, 340 μ g, 345 μ g, 350 μ g, 355 μ g, 360 μ g, 365 μ g, 20
370 μ g, 375 μ g, 380 μ g, 385 μ g, 390 μ g, 395 μ g, 400 μ g, 405 μ g, 410 μ g, 415 μ g, 420 μ g, 425 μ g, 430 μ g, 435 μ g, 440 μ g, 445 μ g, 450 μ g, 455 μ g, 460 μ g, 465 μ g, 470 μ g, 475 μ g, 480 μ g, 485 μ g, 490 μ g, 495 μ g, 500 μ g, 505 μ g, 510 μ g, 515 μ g, 520 μ g, 525 μ g, 530 μ g, 535 μ g, 540 μ g, 545 μ g, 550 μ g, 555 μ g, 560 μ g, 565 μ g, 570 μ g, 575 μ g, 580 μ g, 585 μ g, 590 μ g, 595 μ g, 600 μ g, 605 μ g, 610 μ g, 615 μ g, 620 μ g, 625 μ g, 630 μ g, 635 μ g, 640 μ g, 25
645 μ g, 650 μ g, 655 μ g, 660 μ g, 665 μ g, 670 μ g, 675 μ g, 680 μ g, 685 μ g, 690 μ g, 695 μ g, 700 μ g, 705 μ g, 710 μ g, 715 μ g, 720 μ g, 725 μ g, 730 μ g, 735 μ g, 740 μ g, 745 μ g, 750 μ g, 755 μ g, 760 μ g, 765 μ g, 770 μ g, 775 μ g, 780 μ g, 785 μ g, 790 μ g, 795 μ g, 800 μ g, 805 μ g, 810 μ g, 815 μ g, 820 μ g, 825 μ g, 830 μ g, 835 μ g, 840 μ g, 845 μ g, 850 μ g, 855 μ g, 860 μ g, 865 μ g, 870 μ g, 875 μ g, 880 μ g, 885 μ g, 890 μ g, 895 μ g, 900 μ g, 905 μ g, 910 μ g, 915 μ g, 30
920 μ g, 925 μ g, 930 μ g, 935 μ g, 940 μ g, 945 μ g, 950 μ g, 955 μ g, 960 μ g, 965 μ g, 970 μ g, 975 μ g, 980 μ g, 985 μ g, 990 μ g, 995 μ g, 1000 μ g, 1005 μ g, 1010 μ g, 1015 μ g, 1020 μ g, 1025 μ g, 1030 μ g, 1035 μ g, 1040 μ g, 1045 μ g, 1050 μ g, 1055 μ g, 1060 μ g, 1065 μ g, 1070 μ g, 1075 μ g, 1080 μ g, 1085 μ g, 1090 μ g, 1095 μ g, 1100 μ g, 1105 μ g, 1110 μ g, 1115 μ g, 1120 μ g, 1125 μ g, 1130 μ g, 1135 μ g, 1140 μ g, 1145 μ g, 1150 μ g, 1155 μ g, 1160 μ g, 1165 μ g, 1170 μ g, 1175 μ g, 35
1180 μ g, 1185 μ g, 1190 μ g, 1195 μ g, 1200 μ g, 1250 μ g, 1300 μ g, 1350 μ g, 1400 μ g, 1450 μ g,

1500 μ g, 1550 μ g, 1600 μ g, 1650 μ g, 1700 μ g, 1750 μ g, 1800 μ g, 1850 μ g, 1900 μ g, 1950 μ g, 2000 μ g or similar. The suggested dosages per single dose specified above are not to be regarded as being limited to the numerical values actually stated, but are intended as dosages which are disclosed by way of example. Of course, dosages which may fluctuate 5 about the abovementioned numerical values within a range of about +/- 2.5 μ g are also included in the values given above by way of example. In these dosage ranges, the active substances 1' and 2 may be present in the weight ratios given above.

For example, without restricting the scope of the invention thereto, the combinations of 1 and 2 according to the invention may contain a quantity of tiotropium 1' and soluble TNF 10 receptor fusion protein 2 such that, for each single dose, 5 μ g of 1' and 50 μ g of 2, 5 μ g of 1' and 100 μ g of 2, 5 μ g of 1' and 200 μ g of 2, 5 μ g of 1' and 300 μ g of 2, 5 μ g of 1' and 400 μ g of 2, 5 μ g of 1' and 500 μ g of 2, 5 μ g of 1' and 600 μ g of 2, 5 μ g of 1' and 700 μ g of 2, 5 μ g of 1' and 800 μ g of 2, 5 μ g of 1' and 900 μ g of 2, 5 μ g of 1' and 1000 μ g of 2, 5 μ g of 1' and 1500 μ g of 2, 5 μ g of 1' and 2000 μ g of 2, 10 μ g of 1' and 50 μ g of 2, 10 μ g of 1' and 100 μ g of 2, 10 μ g of 1' and 200 μ g of 2, 10 μ g of 1' and 300 μ g of 2, 10 μ g of 1' and 400 μ g of 2, 10 μ g of 1' and 500 μ g of 2, 10 μ g of 1' and 600 μ g of 2, 10 μ g of 1' and 700 μ g of 2, 10 μ g of 1' and 800 μ g of 2, 10 μ g of 1' and 900 μ g of 2, 10 μ g of 1' and 1000 μ g of 2, 10 μ g of 1' and 1500 μ g of 2, 10 μ g of 1' and 2000 μ g of 2, 18 μ g of 1' and 50 μ g of 2, 18 μ g of 1' and 100 μ g of 2, 18 μ g of 1' and 200 μ g of 2, 18 μ g of 1' and 300 μ g of 2, 18 μ g of 1' and 400 μ g of 2, 18 μ g of 1' and 500 μ g of 2, 18 μ g of 1' and 600 μ g of 2, 18 μ g of 1' and 700 μ g of 2, 18 μ g of 1' and 800 μ g of 2, 18 μ g of 1' and 900 μ g of 2, 18 μ g of 1' and 1000 μ g of 2, 18 μ g of 1' and 1500 μ g of 2, 18 μ g of 1' and 2000 μ g of 2, 20 μ g of 1' and 50 μ g of 2, 20 μ g of 1' and 50 μ g of 2, 20 μ g of 1' and 100 μ g of 2, 20 μ g of 1' and 200 μ g of 2, 20 μ g of 1' and 300 μ g of 2, 20 μ g of 1' and 400 μ g of 2, 20 μ g of 1' and 500 μ g of 2, 20 μ g of 1' and 600 μ g of 2, 20 μ g of 1' and 700 μ g of 2, 20 μ g of 1' and 800 μ g of 2, 20 μ g of 1' and 900 μ g of 2, 20 μ g of 1' and 1000 μ g of 2, 20 μ g of 1' and 1500 μ g of 2, 20 μ g of 1' and 2000 μ g of 2, 36 μ g of 1' and 50 μ g of 2, 36 μ g of 1' and 100 μ g of 2, 36 μ g of 1' and 200 μ g of 2, 36 μ g of 1' and 300 μ g of 2, 36 μ g of 1' and 400 μ g of 2, 36 μ g of 1' and 500 μ g of 2, 36 μ g of 1' and 600 μ g of 2, 36 μ g of 1' and 700 μ g of 2, 36 μ g of 1' and 800 μ g of 2, 36 μ g of 1' and 900 μ g of 2, 36 μ g of 1' and 1000 μ g of 2, 36 μ g of 1' and 1500 μ g of 2, 36 μ g of 1' and 2000 μ g of 2, 40 μ g of 1' and 50 μ g of 2, 40 μ g of 1' and 100 μ g of 2, 40 μ g of 1' and 200 μ g of 2, 40 μ g of 1' and 300 μ g of 2, 40 μ g of 1' and 400 μ g of 2, 40 μ g of 1' and 500 μ g of 2, 40 μ g of 1' and 600 μ g of 2 or 40 μ g of 1' and 700 μ g of 2, 40 μ g of 1' and 800 μ g of 2, 40 μ g of 1' and 900 μ g of 2, 40 μ g of 1' and 1000 μ g of 2.

1' and 1000 μ g of 2, 40 μ g of 1' and 1500 μ g of 2, 40 μ g of 1' and 2000 μ g of 2 are administered

If the active substance combination in which 1 denotes tiotropium bromide is used as the preferred combination of 1 and 2 according to the invention, the quantities of active substance 1' and 2 administered per single dose mentioned by way of example correspond to the following quantities of 1 and 2 administered per single dose: 6 μ g of 1 and 50 μ g of 2, 6 μ g of 1 and 100 μ g of 2, 6 μ g of 1 and 200 μ g of 2, 6 μ g of 1 and 300 μ g of 2, 6 μ g of 1 and 400 μ g of 2, 6 μ g of 1 and 500 μ g of 2, 6 μ g of 1 and 600 μ g of 2, 6 μ g of 1 and 700 μ g of 2, 6 μ g of 1 and 800 μ g of 2, 6 μ g of 1 and 900 μ g of 2, 6 μ g of 1 and 1000 μ g of 2, 6 μ g of 1 and 1500 μ g of 2, 6 μ g of 1 and 2000 μ g of 2, 12 μ g of 1 and 50 μ g of 2, 12 μ g of 1 and 100 μ g of 2, 12 μ g of 1 and 200 μ g of 2, 12 μ g of 1 and 300 μ g of 2, 12 μ g of 1 and 400 μ g of 2, 12 μ g of 1 and 500 μ g of 2, 12 μ g of 1 and 600 μ g of 2, 12 μ g of 1 and 700 μ g of 2, 12 μ g of 1 and 800 μ g of 2, 12 μ g of 1 and 900 μ g of 2, 12 μ g of 1 and 1000 μ g of 2, 12 μ g of 1 and 1500 μ g of 2, 12 μ g of 1 and 2000 μ g of 2, 21.7 μ g of 1 and 50 μ g of 2, 21.7 μ g of 1 and 100 μ g of 2, 21.7 μ g of 1 and 200 μ g of 2, 21.7 μ g of 1 and 300 μ g of 2, 21.7 μ g of 1 and 400 μ g of 2, 21.7 μ g of 1 and 500 μ g of 2, 21.7 μ g of 1 and 600 μ g of 2, 21.7 μ g of 1 and 700 μ g of 2, 21.7 μ g of 1 and 800 μ g of 2, 21.7 μ g of 1 and 900 μ g of 2, 21.7 μ g of 1 and 1000 μ g of 2, 21.7 μ g of 1 and 1500 μ g of 2, 21.7 μ g of 1 and 2000 μ g of 2, 24.1 μ g of 1 and 50 μ g of 2, 24.1 μ g of 1 and 100 μ g of 2, 24.1 μ g of 1 and 200 μ g of 2, 24.1 μ g of 1 and 300 μ g of 2, 24.1 μ g of 1 and 400 μ g of 2, 24.1 μ g of 1 and 500 μ g of 2, 24.1 μ g of 1 and 600 μ g of 2, 24.1 μ g of 1 and 700 μ g of 2, 24.1 μ g of 1 and 800 μ g of 2, 24.1 μ g of 1 and 900 μ g of 2, 24.1 μ g of 1 and 1000 μ g of 2, 24.1 μ g of 1 and 1500 μ g of 2, 24.1 μ g of 1 and 2000 μ g of 2, 43.3 μ g of 1 and 50 μ g of 2, 43.3 μ g of 1 and 100 μ g of 2, 43.3 μ g of 1 and 200 μ g of 2, 43.3 μ g of 1 and 300 μ g of 2, 43.3 μ g of 1 and 400 μ g of 2, 43.3 μ g of 1 and 500 μ g of 2, 43.3 μ g of 1 and 600 μ g of 2, 43.3 μ g of 1 and 700 μ g of 2, 43.3 μ g of 1 and 800 μ g of 2, 43.3 μ g of 1 and 900 μ g of 2, 43.3 μ g of 1 and 1000 μ g of 2, 43.3 μ g of 1 and 1500 μ g of 2, 43.3 μ g of 1 and 2000 μ g of 2, 48.1 μ g of 1 and 50 μ g of 2, 48.1 μ g of 1 and 100 μ g of 2, 48.1 μ g of 1 and 200 μ g of 2, 48.1 μ g of 1 and 300 μ g of 2, 48.1 μ g of 1 and 400 μ g of 2, 48.1 μ g of 1 and 500 μ g of 2, 48.1 μ g of 1 and 600 μ g of 2, 48.1 μ g of 1 and 700 μ g of 2, 48.1 μ g of 1 and 800 μ g of 2, 48.1 μ g of 1 and 900 μ g of 2, 48.1 μ g of 1 and 1000 μ g of 2, 48.1 μ g of 1 and 1500 μ g of 2, 48.1 μ g of 1 and 2000 μ g of 2.

If the active substance combination in which 1 denotes tiotropium bromide monohydrate is used as the preferred combination of 1 and 2 according to the invention, the quantities of 1' and

2 administered per single dose specified by way of example hereinbefore correspond to the following quantities of 1 and 2 administered per single dose: 6.2 μ g of 1 and 50 μ g of 2, 6.2 μ g of 1 and 100 μ g of 2, 6.2 μ g of 1 and 200 μ g of 2, 6.2 μ g of 1 and 300 μ g of 2, 6.2 μ g of 1 and 400 μ g of 2, 6.2 μ g of 1 and 500 μ g of 2, 6.2 μ g of 1 and 600 μ g of 2, 6.2 μ g of 1 and 700 μ g of 2, 6.2 μ g of 1 and 800 μ g of 2, 6.2 μ g of 1 and 900 μ g of 2, 6.2 μ g of 1 and 1000 μ g of 2, 6.2 μ g of 1 and 1500 μ g of 2, 6.2 μ g of 1 and 2000 μ g of 2, 12.5 μ g of 1 and 50 μ g of 2, 12.5 μ g of 1 and 100 μ g of 2, 12.5 μ g of 1 and 200 μ g of 2, 12.5 μ g of 1 and 300 μ g of 2, 12.5 μ g of 1 and 400 μ g of 2, 12.5 μ g of 1 and 500 μ g of 2, 12.5 μ g of 1 and 600 μ g of 2, 12.5 μ g of 1 and 700 μ g of 2, 12.5 μ g of 1 and 800 μ g of 2, 12.5 μ g of 1 and 900 μ g of 2, 12.5 μ g of 1 and 1000 μ g of 2, 12.5 μ g of 1 and 1500 μ g of 2, 12.5 μ g of 1 and 2000 μ g of 2, 22.5 μ g of 1 and 50 μ g of 2, 22.5 μ g of 1 and 100 μ g of 2, 22.5 μ g of 1 and 200 μ g of 2, 22.5 μ g of 1 and 300 μ g of 2, 22.5 μ g of 1 and 400 μ g of 2, 22.5 μ g of 1 and 500 μ g of 2, 22.5 μ g of 1 and 600 μ g of 2, 22.5 μ g of 1 and 700 μ g of 2, 22.5 μ g of 1 and 800 μ g of 2, 22.5 μ g of 1 and 900 μ g of 2, 22.5 μ g of 1 and 1000 μ g of 2, 22.5 μ g of 1 and 1500 μ g of 2, 22.5 μ g of 1 and 2000 μ g of 2, 25 μ g of 1 and 50 μ g of 2, 25 μ g of 1 and 100 μ g of 2, 25 μ g of 1 and 200 μ g of 2, 25 μ g of 1 and 300 μ g of 2, 25 μ g of 1 and 400 μ g of 2, 25 μ g of 1 and 500 μ g of 2, 25 μ g of 1 and 600 μ g of 2, 25 μ g of 1 and 700 μ g of 2, 25 μ g of 1 and 800 μ g of 2, 25 μ g of 1 and 900 μ g of 2, 25 μ g of 1 and 1000 μ g of 2, 25 μ g of 1 and 1500 μ g of 2, 25 μ g of 1 and 2000 μ g of 2, 45 μ g of 1 and 50 μ g of 2, 45 μ g of 1 and 100 μ g of 2, 45 μ g of 1 and 200 μ g of 2, 45 μ g of 1 and 300 μ g of 2, 45 μ g of 1 and 400 μ g of 2, 45 μ g of 1 and 500 μ g of 2, 45 μ g of 1 and 600 μ g of 2, 45 μ g of 1 and 700 μ g of 2, 45 μ g of 1 and 800 μ g of 2, 45 μ g of 1 and 900 μ g of 2, 45 μ g of 1 and 1000 μ g of 2, 45 μ g of 1 and 1500 μ g of 2, 45 μ g of 1 and 2000 μ g of 2, 50 μ g of 1 and 50 μ g of 2, 50 μ g of 1 and 100 μ g of 2, 50 μ g of 1 and 200 μ g of 2, 50 μ g of 1 and 300 μ g of 2, 50 μ g of 1 and 400 μ g of 2, 50 μ g of 1 and 500 μ g of 2, 50 μ g of 1 and 600 μ g of 2, 50 μ g of 1 and 700 μ g of 2, 50 μ g of 1 and 800 μ g of 2, 50 μ g of 1 and 900 μ g of 2 or 50 μ g of 1 and 1000 μ g of 2, 50 μ g of 1 and 1500 μ g of 2, 50 μ g of 1 and 2000 μ g of 2

The aforementioned examples of possible doses applicable for the combinations according to the invention are to be understood as referring to doses per single application. However, these examples are not be understood as excluding the possibility of administering the combinations according to the invention multiple times. Depending on the medical need patients may receive also multiple inhalative applications. As an example patients may receive the combinations according to the invention for instance two or three times (e.g. 30 two or three puffs with a powder inhaler, an MDI etc) in the morning as well. As the 35 two or three puffs with a powder inhaler, an MDI etc) in the morning as well.

aforementioned dose examples are only to be understood as dose examples per single application (i.e. per puff) multiple application of the combinations according to the invention leads to multiple doses of the aforementioned examples.

5 Moreover it is emphasised that the aforementioned dose examples are to be understood as examples of metered doses only. In other terms, the aforementioned dose examples are not to be understood as the effective doses of the combinations according to the invention that do in fact reach the lung. It is clear for the person of ordinary skill in the art that the delivered dose to the lung is generally lower than the metered dose of the administered 10 active ingredients.

The active substance combinations of **1** and **2** according to the invention are preferably administered by inhalation. For this purpose, ingredients **1** and **2** have to be made available in forms suitable for inhalation. Inhalable preparations include inhalable powders and 15 inhalable solutions. Inhalable powders according to the invention containing the combination of active substances **1** and **2** may consist of the active substances on their own or of a mixture of the active substances with physiologically acceptable excipients. Within the scope of the present invention, inhalable solutions also includes concentrates or sterile inhalable solutions ready for use in a nebuliser. The preparations according to the invention 20 may contain the combination of active substances **1** and **2** either together in one formulation or in two separate formulations. These formulations which may be used within the scope of the present invention are described in more detail in the next part of the specification.

25 A) Inhalable powder containing the combinations of active substances **1** and **2** according to the invention:

The inhalable powders according to the invention may contain **1** and **2** either on their own or in admixture with suitable physiologically acceptable excipients. If the active substances **1** and **2** are present in admixture with physiologically acceptable 30 excipients, the following physiologically acceptable excipients may be used to prepare these inhalable powders according to the invention: monosaccharides (e.g. glucose or arabinose), disaccharides (e.g. lactose, saccharose, maltose, trehalose), oligo- and polysaccharides (e.g. dextran), polyalcohols (e.g. sorbitol, mannitol, xylitol), salts (e.g. sodium chloride, calcium carbonate) or mixtures of these excipients with one another. 35 Preferably, mono- or disaccharides are used, while the use of lactose, trehalose or glucose

is preferred, particularly, but not exclusively, in the form of their hydrates. For the purposes of the invention, lactose is the particularly preferred excipient, while lactose monohydrate is most particularly preferred.

5 Within the scope of the inhalable powders according to the invention the excipients have a maximum mass mean aerodynamic diameter of up to 250 μm , preferably between 10 and 150 μm , most preferably between 15 and 80 μm . It may sometimes seem appropriate to add finer excipient fractions with a mass mean aerodynamic diameter of 1 to 9 μm to the excipient mentioned above. These finer excipients are also selected from the group of
10 possible excipients listed hereinbefore.

Finally, in order to prepare the inhalable powders according to the invention, active substance 1 and 2, preferably with a mass mean aerodynamic diameter of 0.5 to 10 μm , more preferably from 1 to 5 μm , is added to the excipient mixture. Processes for producing
15 the inhalable powders according to the invention and finally mixing the ingredients together are known from the prior art. These processes may include, but are not limited to, spray drying or grinding and micronising. Particularly favoured are processes which protect the protein component from denaturation during the production of particles of the right size range to be suitable for inhalation. The inhalable powders according to the
20 invention may be prepared and administered either in the form of a single powder mixture which contains both 1 and 2 or in the form of separate inhalable powders which contain only 1 or 2.

The inhalable powders according to the invention may be administered using inhalers known from the prior art. Inhalable powders according to the invention which contain a physiologically acceptable excipient in addition to 1 and 2 may be administered, for example, by means of inhalers which deliver a single dose from a supply using a measuring chamber as described in US 4570630A, or by other means as described in DE 36 25 685 A. Preferably, the inhalable powders according to the invention which contain
30 physiologically acceptable excipient in addition to 1 and 2 are packed into capsules (to produce so-called inhalettes) which are used in inhalers as described, for example, in WO 94/28958.

A particularly preferred inhaler for using the pharmaceutical combination according to the
35 invention in inhalettes is shown in Figure 1.

This inhaler (Handihaler) for inhaling powdered pharmaceutical compositions from capsules is characterised by a housing 1 containing two windows 2, a deck 3 in which there are air inlet ports and which is provided with a screen 5 secured via a screen housing 4, an inhalation chamber 6 connected to the deck 3 on which there is a push button 9 provided 5 with two sharpened pins 7 and movable counter to a spring 8, a mouthpiece 12 which is connected to the housing 1, the deck 3 and a cover 11 via a spindle 10 to enable it to be flipped open or shut and three holes 13 with diameters below 1 mm in the central region around the capsule chamber 6 and underneath the screen housing 4 and screen 5.

The main air flow enters the inhaler between deck 3 and base 1 near to the hinge. The deck 10 has in this range a reduced width, which forms the entrance slit for the air. Then the flow reverses and enters the capsule chamber 6 through the inlet tube. The flow is then further conducted through the filter and filter holder to the mouthpiece. A small portion of the flow enters the device between mouthpiece and deck and flows then between filterholder 15 and deck into the main stream. Due to production tolerances there is some uncertainty in this flow because of the actual width of the slit between filterholder and deck. In case of new or reworked tools the flow resistance of the inhaler may therefore be a little off the target value. To correct this deviation the deck has in the central region around the capsule chamber 6 and underneath the screen housing 4 and screen 5 three holes 13 with diameters below 1 mm. Through these holes 13 flows air from the base into the main air stream and 20 reduces such slightly the flow resistance of the inhaler. The actual diameter of these holes 13 can be chosen by proper inserts in the tools so that the mean flow resistance can be made equal to the target value.

If the inhalable powders according to the invention are packed into capsules (inhalers) for 25 the preferred use described above, the quantities packed into each capsule should be 1 to 30mg, preferably 3 to 20mg, more particularly 5 to 10mg of inhalable powder per capsule. These capsules contain, according to the invention, either together or separately, the doses of 1 and 2 mentioned hereinbefore for each single dose.

30 B) Inhalable solutions or suspensions containing the combinations of active substances 1 and 2 according to the invention:

In another preferred embodiment the active substance combination according to the invention is used in the form of inhalable solutions and suspensions. The solvent / suspending agent used may be aqueous or alcoholic, preferably ethanolic.. The solvent / 35 suspending agent may be water on its own or a mixture of water and ethanol. The relative

proportion of ethanol compared with water is not limited (other than by the requirement that it not cause irreversible denaturation of the protein component of the mixture), but the maximum is up to 70 percent by volume, more particularly up to 60 percent by volume and most preferably up to 30 percent by volume. The remainder of the volume is made up of 5 water. The solutions or suspensions containing **1** and **2**, separately or together, are adjusted to a pH of 2 to 7, preferably 2 to 5, using suitable acids. The pH may be adjusted using acids selected from inorganic or organic acids. Examples of suitable inorganic acids include hydrochloric acid, hydrobromic acid, nitric acid, sulphuric acid and/or phosphoric acid. Examples of particularly suitable organic acids include ascorbic acid, citric acid, 10 malic acid, tartaric acid, maleic acid, succinic acid, fumaric acid, acetic acid, formic acid and/or propionic acid etc. Preferred inorganic acids are hydrochloric and sulphuric acids. It is also possible to use the acids which have already formed an acid addition salt with one of the active substances. Of the organic acids, ascorbic acid, fumaric acid and citric acid are preferred. If desired, mixtures of the above acids may be used, particularly in the case 15 of acids which have other properties in addition to their acidifying qualities, e.g. as flavourings, antioxidants or complexing agents, such as citric acid or ascorbic acid, for example. According to the invention, it is particularly preferred to use hydrochloric acid to adjust the pH.

According to the invention, the addition of editic acid (EDTA) or one of the known salts 20 thereof, sodium edetate, as stabiliser or complexing agent is unnecessary in the present formulation. Other embodiments may contain this compound or these compounds. In a preferred embodiment the content based on sodium edetate is less than 100mg/100ml, preferably less than 50mg/100 ml, more preferably less than 20mg/100 ml. Generally, inhalable solutions in which the content of sodium edetate is from 0 to 10mg/100ml are 25 preferred.

Co-solvents and/or other excipients may be added to the inhalable solutions according to the invention. Preferred co-solvents are those which contain hydroxyl groups or other polar groups, e.g. alcohols - particularly isopropyl alcohol, glycols - particularly 30 propyleneglycol, polyethyleneglycol, polypropyleneglycol, glycoether, glycerol, polyoxyethylene alcohols and polyoxyethylene fatty acid esters. The terms excipients and additives in this context denote any pharmacologically acceptable substance which is not an active substance but which can be formulated with the active substance or substances in the pharmacologically suitable solvent in order to improve the qualitative properties of the 35 active substance formulation. Preferably, these substances have no pharmacological effect

or, in connection with the desired therapy, no appreciable or at least no undesirable pharmacological effect. The excipients and additives include, for example, surfactants such as soya lecithin, oleic acid, sorbitan esters, such as polysorbates, polyvinylpyrrolidone, other stabilisers, complexing agents, antioxidants and/or preservatives which guarantee or 5 prolong the shelf life of the finished pharmaceutical formulation, flavourings, vitamins and/or other additives known in the art. The additives also include pharmacologically acceptable salts such as sodium chloride as isotonic agents.

10 The preferred excipients include antioxidants such as ascorbic acid, for example, provided that it has not already been used to adjust the pH, vitamin A, vitamin E, tocopherols and similar vitamins and provitamins occurring in the human body.

15 Preservatives may be used to protect the formulation from contamination with pathogens. Suitable preservatives are those which are known in the art, particularly cetyl pyridinium chloride, benzalkonium chloride or benzoic acid or benzoates such as sodium benzoate in the concentration known from the prior art. The preservatives mentioned above are preferably present in concentrations of up to 50mg/100ml, more preferably between 5 and 20mg/100ml.

20 Preferred formulations contain, in addition to the solvent water and the combination of active substances **1** and **2**, only benzalkonium chloride and sodium edetate. In another preferred embodiment, no sodium edetate is present.

25 The inhalable solutions according to the invention are administered in particular using inhalers of the kind which are capable of nebulising a small amount of a liquid formulation in the therapeutic dose within a few seconds to produce an aerosol suitable for therapeutic inhalation. Within the scope of the present invention, preferred inhalers are those in which a quantity of less than 100 μ L, preferably less than 50 μ L, more preferably between 10 and 30 μ L of active substance solution can be nebulised in preferably one spray action to form 30 an aerosol with an mass mean aerodynamic diameter of less than 20 μ m, preferably less than 10 μ m, in such a way that the inhalable part of the aerosol corresponds to the therapeutically effective quantity.

An apparatus of this kind for delivery of a metered quantity of a liquid pharmaceutical composition for inhalation is described for example in International Patent Application

WO 91/14468 and also in WO 97/12687 (cf. in particular Figures 6a and 6b). The nebulisers (devices) described therein are known by the name Respimat®.

This nebuliser (Respimat®) can advantageously be used to produce the inhalable aerosols according to the invention containing the combination of active substances **1** and **2**.

5 Because of its cylindrical shape and handy size of less than 9 to 15 cm long and 2 to 4 cm wide, this device can be carried at all times by the patient. The nebuliser sprays a defined volume of pharmaceutical formulation using high pressures through small nozzles so as to produce inhalable aerosols.

10 The preferred atomiser essentially consists of an upper housing part, a pump housing, a nozzle, a locking mechanism, a spring housing, a spring and a storage container, characterised by

- a pump housing which is secured in the upper housing part and which comprises at one end a nozzle body with the nozzle or nozzle arrangement,
- a hollow plunger with valve body,
- a power takeoff flange in which the hollow plunger is secured and which is located in the upper housing part,
- a locking mechanism situated in the upper housing part,
- a spring housing with the spring contained therein, which is rotatably mounted on the upper housing part by means of a rotary bearing,
- a lower housing part which is fitted onto the spring housing in the axial direction.

25 The hollow plunger with valve body corresponds to a device disclosed in WO 97/12687. It projects partially into the cylinder of the pump housing and is axially movable within the cylinder. Reference is made in particular to Figures 1 to 4, especially Figure 3, and the relevant parts of the description. The hollow plunger with valve body exerts a pressure of 5 to 60 Mpa (about 50 to 600 bar), preferably 10 to 60 Mpa (about 100 to 600 bar) on the fluid, the measured amount of active substance solution, at its high pressure end at the moment when the spring is actuated. Volumes of 10 to 50 microlitres are preferred, while 30 volumes of 10 to 20 microlitres are particularly preferred and a volume of 15 microlitres per spray is most particularly preferred.

The valve body is preferably mounted at the end of the hollow plunger facing the valve body.

The nozzle in the nozzle body is preferably microstructured, i.e. produced by microtechnology. Microstructured nozzle bodies are disclosed for example in WO-94/07607; reference is hereby made to the contents of this specification, particularly Figure 1 therein and the associated description.

5

The nozzle body consists for example of two sheets of glass and/or silicon firmly joined together, at least one of which has one or more microstructured channels which connect the nozzle inlet end to the nozzle outlet end. At the nozzle outlet end there is at least one round or non-round opening 2 to 10 microns deep and 5 to 15 microns wide, the depth preferably 10 being 4.5 to 6.5 microns while the length is preferably 7 to 9 microns.

In the case of a plurality of nozzle openings, preferably two, the directions of spraying of the nozzles in the nozzle body may extend parallel to one another or may be inclined relative to one another in the direction of the nozzle opening. In a nozzle body with at least two nozzle openings at the outlet end the directions of spraying may be at an angle of 20 to 15 160° to one another, preferably 60 to 150°, most preferably 80 to 100°. The nozzle openings are preferably arranged at a spacing of 10 to 200 microns, more preferably at a spacing of 10 to 100 microns, most preferably 30 to 70 microns. Spacings of 50 microns are most preferred. The directions of spraying will therefore meet in the vicinity of the nozzle openings.

20

The liquid pharmaceutical preparation strikes the nozzle body with an entry pressure of up to 600 bar, preferably 200 to 300 bar, and is atomised into an inhalable aerosol through the nozzle openings. The preferred particle or droplet sizes of the aerosol are up to 20 microns, preferably 3 to 10 microns.

25

The locking mechanism contains a spring, preferably a cylindrical helical compression spring, as a store for the mechanical energy. The spring acts on the power takeoff flange as an actuating member the movement of which is determined by the position of a locking member. The travel of the power takeoff flange is precisely limited by an upper and lower 30 stop. The spring is preferably biased, via a power step-up gear, e.g. a helical thrust gear, by an external torque which is produced when the upper housing part is rotated counter to the spring housing in the lower housing part. In this case, the upper housing part and the power takeoff flange have a single or multiple V-shaped gear.

The locking member with engaging locking surfaces is arranged in a ring around the power takeoff flange. It consists, for example, of a ring of plastic or metal which is inherently radially elastically deformable. The ring is arranged in a plane at right angles to the atomiser axis. After the biasing of the spring, the locking surfaces of the locking member 5 move into the path of the power takeoff flange and prevent the spring from relaxing. The locking member is actuated by means of a button. The actuating button is connected or coupled to the locking member. In order to actuate the locking mechanism, the actuating button is moved parallel to the annular plane, preferably into the atomiser; this causes the deformable ring to deform in the annual plane. Details of the construction of the locking 10 mechanism are given in WO 97/20590.

The lower housing part is pushed axially over the spring housing and covers the mounting, the drive of the spindle and the storage container for the fluid.

15 When the atomiser is actuated the upper housing part is rotated relative to the lower housing part, the lower housing part taking the spring housing with it. The spring is thereby compressed and biased by means of the helical thrust gear and the locking mechanism engages automatically. The angle of rotation is preferably a whole-number fraction of 360 degrees, e.g. 180 degrees. At the same time as the spring is biased, the 20 power takeoff part in the upper housing part is moved along by a given distance, the hollow plunger is withdrawn inside the cylinder in the pump housing, as a result of which some of the fluid is sucked out of the storage container and into the high pressure chamber in front of the nozzle.

25 If desired, a number of exchangeable storage containers which contain the fluid to be atomised may be pushed into the atomiser one after another and used in succession. The storage container contains the aqueous aerosol preparation according to the invention. The atomising process is initiated by pressing gently on the actuating button. As a result, the locking mechanism opens up the path for the power takeoff member. The biased spring 30 pushes the plunger into the cylinder of the pump housing. The fluid leaves the nozzle of the atomiser in atomised form.

Further details of construction are disclosed in PCT Applications WO 97/12683 and WO 97/20590, to which reference is hereby made.

The components of the atomiser (nebuliser) are made of a material which is suitable for its purpose. The housing of the atomiser and, if its operation permits, other parts as well are preferably made of plastics, e.g. by injection moulding. For medicinal purposes, physiologically safe materials are used.

5

Figures 6a/b of WO 97/12687, show the nebuliser (Respimat®) which can advantageously be used for inhaling the aqueous aerosol preparations according to the invention.

Figure 6a of WO 97/12687 shows a longitudinal section through the atomiser with the spring biased while Figure 6b shows a longitudinal section through the atomiser with the 10 spring relaxed.

The upper housing part (51) contains the pump housing (52) on the end of which is mounted the holder (53) for the atomiser nozzle. In the holder is the nozzle body (54) and a filter (55). The hollow plunger (57) fixed in the power takeoff flange (56) of the locking mechanism projects partially into the cylinder of the pump housing. At its end the hollow 15 plunger carries the valve body (58). The hollow plunger is sealed off by means of the seal (59). Inside the upper housing part is the stop (60) on which the power takeoff flange abuts when the spring is relaxed. On the power takeoff flange is the stop (61) on which the power takeoff flange abuts when the spring is biased. After the biasing of the spring the locking member (62) moves between the stop (61) and a support (63) in the upper housing 20 part. The actuating button (64) is connected to the locking member. The upper housing part ends in the mouthpiece (65) and is sealed off by means of the protective cover (66) which can be placed thereon.

The spring housing (67) with compression spring (68) is rotatably mounted on the upper housing part by means of the snap-in lugs (69) and rotary bearing. The lower housing part 25 (70) is pushed over the spring housing. Inside the spring housing is the exchangeable storage container (71) for the fluid (72) which is to be atomised. The storage container is sealed off by the stopper (73) through which the hollow plunger projects into the storage container and is immersed at its end in the fluid (supply of active substance solution).

The spindle (74) for the mechanical counter is mounted in the covering of the spring 30 housing. At the end of the spindle facing the upper housing part is the drive pinion (75). The slider (76) sits on the spindle.

The nebuliser described above is suitable for nebulising the aerosol preparations according to the invention to produce an aerosol suitable for inhalation.

If the formulation according to the invention is nebulised using the method described above (Respimat®) the quantity delivered should correspond to a defined quantity with a tolerance of not more than 25%, preferably 20% of this amount in at least 97%, preferably at least 98% of all operations of the inhaler (spray actuations). Preferably, between 5 and 5 30 mg of formulation, most preferably between 5 and 20 mg of formulation are delivered as a defined mass on each actuation.

However, the formulation according to the invention may also be nebulised by means of inhalers other than those described above, e.g. jet stream inhalers.

10

Accordingly, in a further aspect, the invention relates to pharmaceutical formulations in the form of inhalable solutions or suspensions as described above combined with a device suitable for administering these formulations, preferably in conjunction with the Respimat®. Preferably, the invention relates to inhalable solutions or suspensions 15 characterised by the combination of active substances 1 and 2 according to the invention in conjunction with the device known by the name Respimat®. In addition, the present invention relates to the above-mentioned devices for inhalation, preferably the Respimat®, characterised in that they contain the inhalable solutions or suspensions according to the invention as described hereinbefore.

20

The inhalable solutions or suspensions according to the invention may take the form of concentrates or sterile inhalable solutions or suspensions ready for use, as well as the above-mentioned solutions and suspensions designed for use in a Respimat®. Formulations ready for use may be produced from the concentrates, for example, by the 25 addition of isotonic saline solutions. Sterile formulations ready for use may be administered using energy-operated fixed or portable nebulisers which produce inhalable aerosols by means of ultrasound or compressed air by the Venturi principle or other principles.

30

Accordingly, in another aspect, the present invention relates to pharmaceutical compositions in the form of inhalable solutions or suspensions as described hereinbefore which take the form of concentrates or sterile formulations ready for use, combined with a device suitable for administering these solutions, characterised in that the device is an energy-operated free-standing or portable nebuliser which produces inhalable aerosols by 35 means of ultrasound or compressed air by the Venturi principle or other methods.

The Examples which follow serve to illustrate the present invention in more detail without restricting the scope of the invention to the following embodiments by way of example.

5 **Examples of Formulations**

A) Inhalable powders:

1)

Ingredients	µg per capsule
tiotropium bromide	21.7
etanercept	200
lactose	4778.3
total	5000

10

2)

Ingredients	µg per capsule
tiotropium bromide	21.7
etanercept	125
lactose	4853.3
total	5000

3)

Ingredients	µg per capsule
tiotropium bromide x H ₂ O	22.5
etanercept	250
lactose	4727.5
total	5000

4)

Ingredients	μg per capsule
tiotropium bromide	21.7
etanercept	250
trehalose	4728.3
total	5000

5)

Ingredients	μg per capsule
tiotropium bromide x H ₂ O	22.5
etanercept	495
trehalose	4482.5
total	5000

5 6)

Ingredients	μg per capsule
tiotropium bromide	21.7
etanercept	400
lactose	4578.3
total	5000

Patent Claims

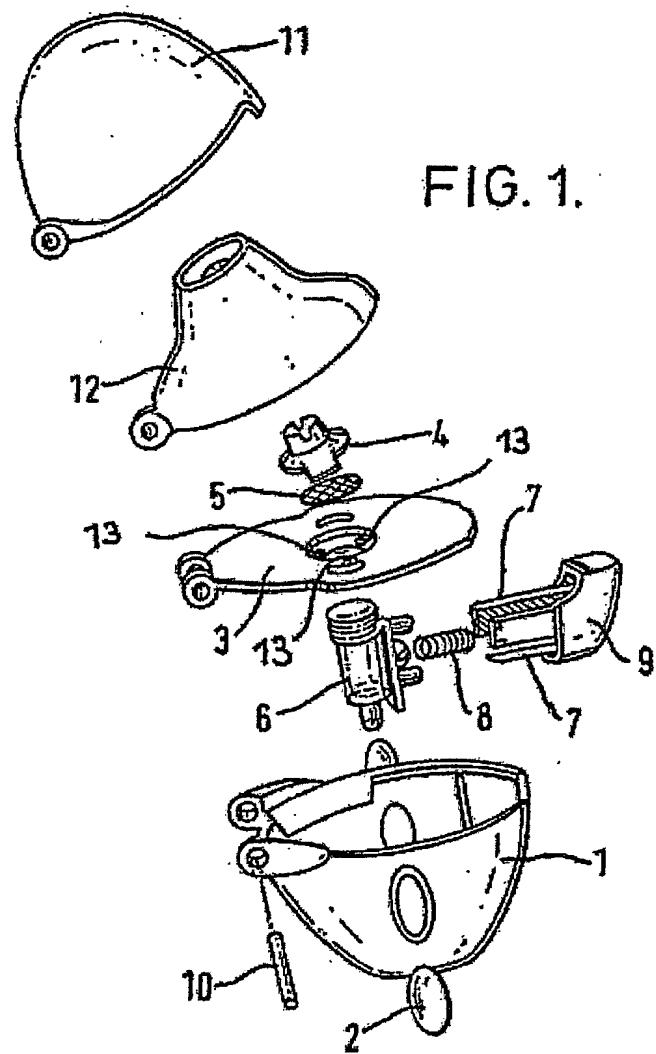
- 1) Pharmaceutical composition, characterised in that it contains one or more anticholinergics 1 in combination with one or more soluble TNF receptor fusion proteins 2 optionally in the form of the individual optical isomers, mixtures thereof or racemates and optionally in the form of the pharmacologically acceptable acid addition salts thereof, optionally in the form of the solvates or hydrates and optionally together with a pharmaceutically acceptable excipient.
- 10 2) Pharmaceutical composition according to claim 1, characterised in that 1 is selected from among the tiotropium salts, oxitropium salts or ipratropium salts, preferably tiotropium salts.
- 15 3) Pharmaceutical composition according to claim 2, characterised in that 1 is present in the form of the chloride, bromide, iodide, methanesulphonate or para-toluenesulphonate, preferably in the form of the bromide.
- 20 4) Pharmaceutical composition according to claims 1, 2 or 3, characterised in that 2 is etanercept or lenercept.
- 25 5) Pharmaceutical composition according to claim 4, characterised in that 2 is etanercept.
- 6) Pharmaceutical composition according to one of claims 1 to 5, characterised in that the active substances 1 and 2 are present either together in a single formulation or in two separate formulations.
- 30 7) Pharmaceutical composition according to one of claims 1 to 6, characterised in that the weight ratios of 1 to 2 are in the range from 1:2000 to 1:1, preferably from 1:1000 to 1:5.
- 8) Pharmaceutical composition according to one of claims 1 to 7, characterised in that a single administration corresponds to a dose of the active substance combination 1 and 2 of 1 to 10000 μ g, preferably from 10 to 5000 μ g.

- 9) Pharmaceutical composition according to one of claims 1 to 8, characterised in that it is in the form of a formulation suitable for inhalation.
- 10) Pharmaceutical composition according to claim 9, characterised in that it is a formulation selected from among inhalable powders and inhalable solutions or suspensions.
- 11) Pharmaceutical composition according to claim 10, characterised in that it is an inhalable powder which contains 1 and 2 in admixture with suitable physiologically acceptable excipients selected from among the monosaccharides, disaccharides, oligo- and polysaccharides, polyalcohols, salts, or mixtures of these excipients with one another.
- 10 12) Inhalable powder according to claim 11, characterised in that the excipient has a maximum mass mean aerodynamic diameter of up to 250 μm , preferably between 10 and 150 μm .
- 13) Capsules, characterised in that they contain an inhalable powder according to claim 11 or 12.
- 15 14) Pharmaceutical composition according to claim 10, characterised in that it is an inhalable powder which contains only the active substances 1 and 2 as its ingredients.
- 15 15) Pharmaceutical composition according to claim 10, characterised in that it is a inhalable solution or suspension which contains water, ethanol or a mixture of water and ethanol as solvent.
- 20 16) Inhalable solution or suspension according to claim 15, characterised in that the pH is 2-7, preferably 2-5.
- 17) Use of a capsule according to claim 13 in an inhaler, preferably in a Handihaler.
- 25 18) Use of an inhalable solution according to one of claims 15 or 16 for nebulising in a suitable inhaler.

19) Use of a composition according to one of claims 1 to 16 for preparing a medicament for treating inflammatory or obstructive diseases of the respiratory tract.

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FIG. 1.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/001143

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K38/19 A61K31/46 A61K9/72 A61P11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, BIOSIS, EMBASE, WPI Data, PASCAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 02/072095 A (BOEHRINGER INGELHEIM PHARMA ; DISSE BERND (DE)) 19 September 2002 (2002-09-19) page 3, lines 6-18 page 2, lines 24-30 page 4, lines 20-31 page 5, lines 8-23 page 7, lines 1,2</p> <p>-----</p> <p style="text-align: center;">-/-</p>	1-19

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
- *L* document which may throw doubts on priority, claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the International filing date but later than the priority date claimed

- *T* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the International search

2 June 2004

Date of mailing of the International search report

08/06/2004

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
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Tel. 010-200-2000 Telex 21 651 epo nl

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/001143

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>BABU K ET AL: "Soluble tumor necrosis factor alpha (TNF-alpha) receptor (Enbrel) as an effective therapeutic strategy in chronic severe asthma." <i>JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY</i>, vol. 111, no. 2 Abstract Supplement, February 2003 (2003-02), page S277, XP009031565 & AAAAI 60TH ANNIVERSARY MEETING; DENVER, CO, USA; MARCH 07-12, 2003 ISSN: 0091-6749 abstract</p> <p>-----</p> <p>BARNES PETER J: "New treatments for COPD." <i>NATURE REVIEWS. DRUG DISCOVERY</i>. JUN 2002, vol. 1, no. 6, June 2002 (2002-06), pages 437-446, XP009031498 ISSN: 1474-1776 page 439, right-hand column, paragraph 3 page 440, right-hand column, paragraph 3; table 1</p> <p>-----</p> <p>HANSEL T T ET AL: "TIOTROPIUM BROMIDE: A NOVEL ONCE-DAILY ANTICHOLINERGIC BRONCHODILATOR FOR THE TREATMENT OF COPD" <i>DRUGS OF TODAY / MEDICAMENTOS DE ACTUALIDAD</i>, J.R. PROUS SS.A. INTERNATIONAL PUBLISHERS, ES, vol. 38, no. 9, September 2002 (2002-09), pages 585-600, XP009022208 ISSN: 0025-7656 page 595, left-hand column, lines 1-3</p> <p>-----</p>	1-19
A	<p>SAADEH CONSTANTINE KHALIL ET AL: "Infliximab therapy for rheumatoid arthritis (RA) induced significant control of asthma in patients with both RA and asthma or asthma/COPD in addition to improving RA status" <i>JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY</i>, vol. 109, no. 1 Supplement, January 2002 (2002-01), page S243, XP009031638 & 58TH ANNUAL MEETING OF THE AMERICAN ACADEMY OF ALLERGY, ASTHMA AND IMMUNOLOGY; NEW YORK, NY, USA; MARCH 01-06, 2002 ISSN: 0091-6749 abstract</p> <p>-----</p>	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/001143

Patent document cited in search report	Publication date		Patent family member(s)	Publication date
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			CA 2440699 A1	19-09-2002
			WO 02072095 A2	19-09-2002
			EP 1385519 A2	04-02-2004
			US 2002193394 A1	19-12-2002
			US 2004039011 A1	26-02-2004